

## **REMARKS**

Reconsideration of this application, as amended, is respectfully requested.

Claims 12-14, 17-19 and 21 are pending. Claims 12, 13, 17-19 and 21 are rejected. Claim 14 is allowed.

Claims 12, 18, and 21 have been amended. No claims have been cancelled. No claims have been added. Support for the amendments is found in the specification, the drawings, and in the claims as originally filed. Applicants submit that the amendments do not add new matter.

### **Rejections Under 35 U.S.C. § 102**

Claims 12-13 and 17 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,514,751 of Bhattacharya ("Bhattacharya"). Claims 12 and 17-18 are rejected under 35 U.S.C 102(e) as being anticipated by U.S. Patent No. 6,452,270 of Huang ("Huang").

Applicants have amended claim 12 to indicate that forming a metal second layer above and on the metal adhesion first layer is performed under conditions to impart a compressive stress therein.

The Examiner stated that

Recorded Prior Art fails to disclose or suggest the combination of the process steps as recited in the base claim 14 including sputtering a copper metal second layer over the metal adhesion first layer under conditions to impart a compressive stress therein; forming a third metal layer above and on the copper metal second layer under condition to impart a compressive stress therein wherein the metal third layer is selected from a group consisting of a refractory metal, a metal doped refractory metal and a refractory metal alloy; forming a solder bump above and on the third layer.

(Office action, p. 8, 07/26/05)

Bhattacharya merely discloses forming a compressively stressed titanium layer on a metal pad on a substrate, and forming Ni/Ru or Cu/Ti/Cu/Au stack on top of the compressively stressed titanium layer (Figures 1-3, col. 2 and 3), in contrast forming a metal second layer under

conditions to impart a compressive stress therein above and on the metal adhesion first layer, as recited in amended claim 12.

Because Bhattacharya does not disclose all the limitations of amended claim 12, Applicants respectfully submit that amended claim 12 is not anticipated by Bhattacharya under 35 U.S.C. § 102(b).

Given that claims 13 and 17 depend from amended independent claim 12, and add additional limitations, applicants respectfully submit that claims 13 and 17 are likewise not anticipated by Bhattacharya under 35 U.S.C. § 102(b).

Claims 12 and 17-18 are rejected under 35 U.S.C 102(e) as being anticipated by Huang. With respect to amended claim 12,

Huang discloses under bump metallurgy. More specifically, Huang discloses

The UBM 340 in accordance with the present invention includes a titanium layer 340a, a first copper layer 340b, a nickel-vanadium layer 340c and a second copper layer 340d. The titanium layer 340a is provided on the passivation layer 330 to form a closed-loop surrounding the opening 330a of the dielectric layer 330. The first copper layer 340b is formed over the titanium layer 340a and the opening 330a of the dielectric layer 330 such that the first copper layer 340b directly contacts the copper contact pad 320. The nickel-vanadium layer 340c is formed on the first copper layer 340b and the second copper layer 340d is formed on the nickel-vanadium layer 340c.

(Huang, col. 3, lines 51-62) (emphasis added)

Thus, Huang merely discloses a copper layer formed over the titanium layer such that the copper layer directly contacts the copper pad, and the nickel-vanadium layer formed on the copper layer and fails to disclose forming a metal second layer under conditions to impart a compressive stress therein above and on the metal adhesion first layer, as recited in amended claim 12.

Because Huang does not disclose all the limitations of amended claim 12, Applicants respectfully submit that amended claim 12 is not anticipated by Huang under 35 U.S.C. § 102(e).

Given that claim 17 depends from amended independent claim 12, and add additional limitations, Applicants respectfully submit that claim 17 is likewise not anticipated by Huang under 35 U.S.C. § 102(e).

Because amended claim 18 contains at least the limitations as discussed above with respect to amended claim 12, Applicants respectfully submit that amended claim 12 is likewise not anticipated by Huang under 35 U.S.C. § 102(e).

### **Rejections Under 35 U.S.C. § 103**

Claim 13 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang in view of Bhattacharya. Claims 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang in view of U.S. Publication No. 2002/0086520 of Chiang (“Chiang”).

As set forth herein above, neither Huang, nor Bhattacharya discloses, teaches, or suggests limitations of amended claim 12 of forming a metal second layer under conditions to impart a compressive stress therein above and on the metal adhesion first layer.

Consequently, even if Huang and Bhattacharya were combined, such a combination would lack such limitations of amended claim 12.

Therefore, Applicants respectfully submit that amended claim 12 is not obvious under 35 U.S.C. § 103 (a) over Huang in view of Bhattacharya.

Given that claim 13 depends from amended claim 12 and adds additional limitations, Applicants respectfully submit that claim 13 is likewise not obvious under § 103 (a) over Huang in view of Bhattacharya.

Claims 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang in view of Chiang.

As discussed above, Huang fails to disclose the limitations of amended claim 18 of sputtering a metal second layer under conditions to impart a compressive stress therein above and on the Ti metal adhesion first layer.

Chiang discloses a titanium layer on the copper contact pad, a nickel-vanadium layer formed on the titanium layer, and a copper layer on the nickel vanadium layer. Importantly, Chiang discloses

It could be understood that the semiconductor device having bump electrodes of the present invention may be formed by the following steps of: (a) Sputtering all metal layers constituting the UBM across the passivation layer 330 and the exposed surface portions of the copper contact pads; (b) selectively etching the deposited metal layers such that only the copper contact pads and the passivation layer nearby are covered with the UBM 340 (see FIG. 3); (c) printing solder onto the UBM 340 over the copper contact pads and the passivation layer nearby; and (d) reflowing.

(Chiang, [0026]) (emphasis added)

Thus, Chiang merely discloses sputtering metal layers, and similarly to Huang, fails to disclose sputtering a metal second layer under conditions to impart a compressive stress therein above and on the Ti metal adhesion first layer, as recited in amended claim 18.

Thus, neither Huang, nor Chiang discloses, teaches, or suggests such limitations of amended claim 18.

Therefore, Applicants respectfully submit that amended claim 18 is not obvious under 35 U.S.C. § 103 (a) over Huang in view of Chiang.

Given that claim 19 depends from amended claim 18 and adds additional limitations, Applicants respectfully submit that claim 19 is likewise not obvious under § 103 (a) over Huang in view of Chiang.

Because amended claim 21 contains at least the limitations as discussed above with respect to amended claim 18, Applicants respectfully submit that amended claim 21 is likewise not obvious under § 103 (a) over Huang in view of Chiang.

#### **Allowable Subject Matter**

Applicant notes with appreciation the Examiner's allowance of the claim 14.

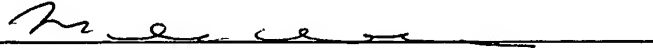
**Conclusion**

It is respectfully submitted that in view of the amendments and arguments set forth herein, the applicable rejections and objections have been overcome. If there are any additional charges, please charge Deposit Account No. 02-2666 for any fee deficiency that may be due.

Respectfully submitted,

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